Murder on the Beach: A Crime Scene Investigation

Just the Facts

A victim of foul play (as determined by the coroner) was found on Prospector's Cove, a beach known for its distinctive sand. Someone stabbed Mr. Rocky Top, a construction worker, numerous times and then left him for dead. He died approximately two hours later, as determined by the autopsy. Samples of sand, dirt and other crystalline substances were collected from the victim's clothing. Within the next few days, investigators followed various leads and identified seven suspects. All seven suspects had a motive for harming Mr. Top. The suspects are:

1. Mrs. Tippy Top: The victim's wife.
2. Mr. George Timber: One of the victim's business partners.
3. Mr. Iron Nails: Another business partner.
4. Mr. I. M. Greedy: The victim's business consultant.
5. Miss Tina Typo: The victim's secretary.
6. Mrs. Glenda Blender: The victim's cook.
7. Mr. Sandy Soil: The victim's gardener.

During the investigation, detectives found samples on what appeared to be sand among the suspects' belongings. Four of the suspects said that they had indeed been to a beach on the day that Mr. Top was murdered; however none admitted to being at Prospector's Cove. The remaining three suspects stated that they were nowhere near a beach on the day of the murder.

As a crime scene technician, your job is to evaluate the crystalline evidence found on the victim to that found on each of the suspects. Determine how your results will impact the investigation.

Procedure

Analyze the crystalline evidence from the crime scene (victim) and each of the seven suspects for the following characteristics and properties. Record your observations and data on the Data Table.

- Physical Properties: Observe and evaluate each sample under the microscope and with the UV light for each of the following: (refer to Background Information Sheet)
  - size
  - color
  - texture
  - luster
- Physical Composition: Use the microscope, magnet, to evaluate each sample.
  - plant material
  - shells
  - coral
  - mineral type
- Chemical Composition:
  - pH
  - HCl

Background Mineral Information

Physical Properties

- **Color**
  The color of a mineral is a useful identification feature. Many minerals, however, occur in a variety of colors, while a large number of minerals are white or colorless. It is for this reason that we cannot rely solely on color to identify minerals.

- **Texture**
  Texture is the characteristic appearance of a crystal referred to as the "habit." Some descriptive terms to identify a crystal's habit are:
- Dendritic: has plant-like shape, as in copper.
- Bladed: appears as layers that look like blades of knives, as in actinolite.
- Acicular: forms as pointy, needle-like masses, as in scolecite.
- Massive: has no definite shape, as in limonite.
- Prismatic: looks like many prisms fused together, as in barite.
- Reniform: looks like a jumble of rounded masses, as in hemite.

  More common descriptors for texture include: rough, bumpy, smooth, pointed, glass-like, jagged, course, fine.

- **Luster**
  Luster describes the way light is reflected off a mineral's surface. The type and intensity of luster vary according to the nature of the mineral surface and the amount and type of light absorbed. Some material will fluoresce under UV light.
  Caution: Do not look directly at the UV light.

- **Size**
  For the purpose of this experiment, you only need to compare crystal sizes to each other. Utilize a scale with #1 as the "smallest" and #7 as the "largest" and the other crystals can be described in numerical order between the two extremes.

Chemical Composition

The presence of carbonate or bicarbonate compounds (a major component of shells and skeletons) react with HCl (hydrochloric acid) to produce CO_2.
$NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$

Physical Composition

- **Biogenic:** fragmented or whole remains of marine animals and plants that have hard skeletons of calcium carbonate. These organisms include corals, mollusks, sea urchins, single-celled animals called "foraminifera" and algae.
- **Detrital:** components are fragments of rock due to erosion and weathering.
    - **Quartz:** usually glassy looking clear; may be pink, yellow, milky, white from granite; grains will scratch glass.
    - **Calcite**: (calcium carbonate) usually present as shell fragments; may be any color but ALWAYS effervesces in dilute HCl.
    - **Magnetite**: usually black in color, reacts to magnet; source meteorites.
    - **Obsidian**: usually black in color; very glassy in appearance; may show pits or pores; may show conchoidal fracture pattern; associated with active volcanoes.
    - **Peridot or Olivine**: usually glassy looking, pistachio or olive green color.
    - **Garnet**: usually reddish brown color; glassy looking; looks like quartz.

Murder on the Beach: A Crime Scene Investigation Data Table

Sample Analyzed	Physical Properties				Chemical Composition		Physical Composition	
	color	texture	luster	size	HCl	pH	biogenic	detrial
Victim								
#1 Mrs. Top								
#2 Mr. Timber								
#3 Mr. Nails								
#4 Mr. Greedy								
#5 Miss Typo								
#6 Mrs. Blender								
#7 Mr. Soil								